High Resolution Studies of the Ion and Neutral Spectra as a Probe of the Magnetic Field Structure

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It has been suggested that under average interstellar field strengths the cyclotron interaction between ions and magnetic fields is strong enough to narrow the linewidth and suppress the line wings in the ion spectra (Houde et al. 2000, ApJ, 536, 857). This effect provides an exciting new approach to probe the presence of magnetic fields. When combined with the Zeeman and dust/CO polarization, it enables determining the 3-D structure of the magnetic fields. Previous single dish observations indeed show larger velocity dispersions in HCN than in HCO^+. However, if the beam is large enough to include the spectral line emission from different physical components, the differences in the velocity dispersions of the ion/neutral spectra may not unambiguously represent the cyclotron interaction. Furthermore, the presence of chemical differentiation between the ion and the neutral species across the beam will also make the ion/neutral spectra comparison meaningless to study the cyclotron effect. In order to mitigate these problems, we have obtained high spatial resolution spectral line images of HCN, HCO^+, $H^{13}CN$, $H^{13}CO^+$, ^{13}CS, and N_2H^+ at 3mm in DR21(OH) with the millimeter array of the Owens Valley Radio Observatory. We present the analysis of the spectral line widths and shapes across the DR21(OH) core to investigate the cyclotron interaction as a probe of magnetic fields. We use our results along with the existing Zeeman and dust/CO polarization data to discuss the 3-D magnetic field structure in this core.

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